

5-2012

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## Recommended Citation

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Pragmatic and Semantic Contributions to  
Social Cognitive Development  
In Children with Down syndrome

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Communication Disorders  
Honors Thesis  
2012

### Abstract

This study sought to investigate how children with Down syndrome (DS) develop social cognition. This is an important topic because there have been few studies that have examined this as a developmental phenomena. The participants in the study were six families, three of these families had children 8-10 months of age and three had children between 16 and 18 months of age. Three of these infants were diagnosed with Down syndrome and three of them had no developmental issues. Data was collected using the MacArthur-Bates Development Inventories (Fenson, Marchman, Thal, Dale, Reznick & Bates, 2007) and a developmental questionnaire. The results found that in typically developing children, as language comprehension increased with age so did social cognitive intent. When Down syndrome participants were compared with their typically developing peers they comprehended considerably fewer words and produced fewer social intention items on the McArthur Bates Development Inventories. Children with Down syndrome develop much less language at the same time as their same aged peers and therefore develop social cognitive intent much later.

### Social Cognitive Development in Children with Down syndrome

Down syndrome is a chromosomal disorder in which a person has three, rather than two, copies of the 21<sup>st</sup> chromosome (“Down Syndrome Fact Sheet”, 2010). It is caused by an error in cell division called non-disjunction which results in an embryo with 3 copies of three copies of chromosome 21. Down syndrome affects more than 400,000 thousand people in the United States alone. These individuals may experience many different medical conditions such as congenital heart defects, respiratory and hearing problems, children leukemia, just to name a few. People with Down syndrome also have very present physical features. They have very low muscle tone, small stature, an upward slant to the eyes, and a single deep crease across the palm of their hands.

Many people think that just because a person with Down syndrome has physical defects they also experience, emotional, cognitive, and social differences. This stereotype has been challenged in recent years as individuals with DS have entered college, have increasingly been gainfully employed, and have contributed to our culture in film and print. Success in these areas are linked to social cognition, the study of which focuses on how people learn to think, problem-solve and remember in conjunction with others rather than biological intactness. Social cognition has been studied as part of the normal developmental process and in some special populations, such as autism spectrum disorder. However, there has been little research that investigates the development of social cognition in individuals with DS. Given the changes in functional life experiences of these individuals as noted above, there is clearly a need for such research from an early developmental perspective. This study looked at how social

cognition develops in children with Down syndrome. Research has focused on how children with DS acquire basic skills and how they used these when faced with new learning (Auerbach, Mirenda & Katz, 2002). Investigations of infant development for individuals with DS have continued with this focus. Given the importance of social cognitive change for developmental outcomes in later life, it is essential that infancy research consider early social cognitive development in the DS population. This study investigated this developmental phenomenon.

### Review of the Literature

#### *Social Cognition and Infant Development*

Social cognition describes how we process information that pertains to other people that are in our social world. How we think about them, how we relate to them, and how we know that their thoughts exist. But how do we develop this social cognition? Is it innate? Are we born with it? Or does it develop as we develop as human beings?

Theorists such as Freud, Piaget, and Skinner all agreed that newborn infants have no idea about the “others” in their world even as they claim that building connections to others is a task of development importance (Meltzoff, 2011). This can be contrasted with scholars who seek to understand development from a social and cultural perspective. For instance, Bratten (2008) has investigated the ways in which even newborns imitate and reflect attunement with social others, and Trevarthen (2001) has theorized about the inherent socialness of human from the perspective of intersubjectivity. Developmental scientists over the last 30 years, beginning with Bruner (1978), have found that there is a very rich innate nature to the minds of infants. Even though infants don’t have language

when they are born, theorists suspect that an infant is born with specific awareness to receptive and subjective states in other people (Aitken & Trevarthen, 2001). A theory called the “Like Me” that proposes three developmental stages has been developed. The “Like Me” theory, which starts at birth and continues through childhood, proposes that at birth the infant has a link between the “perception and production of human acts” (Meltzoff, 2011, p.53). The newborn sees the movements of others and processes them as being “like me” and it provides a foundation for learning about others. Next, this theory proposes that infants make a connection between their own mental experiences and bodily states. This, in turn, connects internal states and behavior. “When infants see others acting similarly to how they have acted in the past, they make an attribution” (Meltzoff, 2011; pg. 53), which is the last phase of the “Like Me” theory. Because of this attribution, infants have the feelings that go along with the behaviors that they see and this gives them a way to understand what others are thinking and feeling before they have language (Meltzoff, 2011). Imitation also plays a big role in social cognition as infants see the behaviors of others and start to produce similar behavior, thus making a connection between self and others (Meltzoff, 2011).

In the past, the study of cognition in infants and young children has focused on the generality of domains and processes within their minds (Yamaguchi, Kuhlmeier, Wynn, & vanMarle, 2009). However, in recent decades, the study of cognition has begun to focus on domain specificity and specific systems and processes within the mind that focuses on specific kinds of information (Yamaguchi, Kuhlmeier, Wynn, & vanMarle, 2009). Research shows that infants can differentiate between “social, animate entities and nonsocial, inanimate entities” (Yamaguchi et al. 2009, p.67). For example,

research states that infants will see the movement of a human hand as having a goal, but the movement of a stick as just moving in space (Yamaguchi et al., 2009). This evidence suggests that infants take in social stimuli differently than nonsocial stimuli (Yamaguchi et al., 2009). Research shows that infants have a natural need for social stimuli and that they engage in social acts when they respond to actions and spoken words of their caregivers (Aitken & Trevarthen, 2001). From this research it is evident that social cognitions does develop as the infant develops but there is an innate foundation at birth for it to develop.

### *Down syndrome and Developmental Risk*

Down syndrome is a chromosomal disorder in which a person has three, rather than two, copies of the 21<sup>st</sup> chromosome (“Down Syndrome Fact Sheet”, 2010). As a result of having this extra chromosome, each gene may be producing more protein product than it is normally supposed to. Down syndrome causes individuals to have difficulties with many processes that the brain controls. Individuals with Down syndrome have difficulties learning language, with cognitive processes, and with social processes.

Children with Down syndrome also have developmental delays along with noticeable physical features. In general, children with Down syndrome reach developmental milestones several months later than the typically developing child (“Down Syndrome-Child Development”, 2009). For example, typically developing children stands alone at 9 months whereas a child with Down syndrome doesn’t stand alone until 12 months (“Down Syndrome-Child Development”, 2009). A typically developing child passes objects from hand to hand beginning at 4 months but a child

with Down syndrome doesn't start to do that until 6 months ("Down Syndrome-Child Development", 2009).

### Social Cognition and Down Syndrome

In recent research on Down syndrome, social cognition has been defined as "the ability to make sense of other people and the ability to plan and execute appropriate ways of responding in everyday social contexts" (Cebula, Moore, & Wishart, 2010). In the past, children with Down syndrome have only participated as control subjects in social cognition studies because it has been assumed that, apart from delayed cognitive ability, children with Down syndrome are socially typical (Cebula, Moore, & Wishart, 2010). This assumption, though, may not be correct. It has been found that children with DS have differences in social attention than typically developing children (Cebula et al., 2010). Mutual gaze, pointing and requesting gestures, imitation and social referencing are areas of social cognitive difficulty in children with DS (Cebula et al., 2010).

Although some may think that because children with Down syndrome are so outgoing and personable that their social skills are developing typically, engaging with others and understanding their emotions may not be as easy for them as for their typically developing peers (Cebula et al., 2010). As with other difficulties, the development of interpersonal understanding is affected by both biological and environmental factors (Cebula et al., 2010). As stated before, social cognition in children with DS is a topic that hasn't been researched very much. There is not much evidence of how it develops but more studies are beginning to be conducted.

"Socio-cognitive skills lie at the heart of interpersonal interactions and are seen as a major driver of cognitive and socio-emotional growth" (Wishart. 2007). Because of



the cognitive development impairment that is usually associated with Down syndrome it is assumed that socio-cognitive development may be impaired as well. But it seems that some of the hardships with socio-cognitive development may be greater. In one study, the theory of mind of typically developing children was compared to that of children with DS. “Theory of mind refers to the coherent body of knowledge about the human mind that we typically use to predict and explain our own behavior and that of others” (“The Linguistic and Cognitive Profile of Down Syndrome.” 2011). This is one dimension of social cognition and it is important for a number of social tasks. In order to measure theory of mind a false belief task was performed so that the researchers could assess the ability of the participant to reason about another person’s beliefs when those beliefs are different from their own (“The Linguistic and Cognitive Profile of Down Syndrome.” 2011). As a result of this study the researchers found that the answer was yes. Participants with Down syndrome answered less questions than typically developing children which says that the ability of children with Down syndrome to reason about the mental states of a person who holds different beliefs from their own is more impaired than are their nonverbal cognitive skills (“The Linguistic and Cognitive Profile of Down Syndrome.” 2011).

### *The Role of Language in Social Cognition*

From the above sections of the literature review, it is clear that part of the social interaction available with infants includes the use of language by adults and the increased understanding of this by the developing children. Shared language builds on intersubjectivity and contributes to theory of mind. The difficulty that children with DS have in developing language is well documented in the research literature (Cleland,

Hardcastle, Timmins, Wishart, & Wood, 2010; Estigarribia, Martin, Klusek, & Roberts, 2009; Klein & Sobelman-Rosenthal, 2003). Therefore, it is reasonable to look at the emergence of language and the development of social cognition in tandem for infants with DS.

### *Summary and Questions of the Study*

As can be seen from this review of the literature, social cognition is a topic that has been investigated by developmental researchers. It has links to other developmental phenomena, especially intersubjectivity, attunement, and theory of mind. Studies that focus on the development of infants with DS particular to these topics is limited. This is not the case for studies of language development and DS. There is a rich, longitudinal data base that identifies developmental language differences just as there is an extensive literature on the connection between language and the development of social cognition. Therefore, it can be surmised from the research literature that children with DS may indeed have the underpinning for preverbal social cognition, but that the development of this may be different as language development is delayed. This leads to the specific questions of the study.

1. How is recognition of social intention and language comprehension related in infancy?
2. Does the relationship between recognition of intention and language comprehension differ for infants with DS?

## Methods

### *Participants*

The participants in this study were twenty families, ten of these families had children 8-10 months of age and ten had children between 16 and 18 months of age. Ten of these infants were diagnosed with Down syndrome (five in each age group) and ten of them had no developmental issues. These infants were gender and age matched for the study. The ten infants with Down syndrome served as the clinical population and the ten infants with no developmental issues served as the control group.

### *Materials*

This study used the MacArthur-Bates Development Inventories and a developmental questionnaire that the parents of the infants filled out. The developmental questionnaire had basic demographic questions and items that pertained to social cognitive development. There was one open-ended question that allowed parents to provide examples of social cognition.

### *Procedures*

Families were contacted through the Easter Seals Program and New Heights Church. Packets were distributed to the families via these organizations. The packet included a letter explaining the study, implied consent, the demographic questionnaire, and the McArthur Bates Communicative Development Inventories. The parents then filled out the MacArthur-Bates Communicative Development Inventories and the demographic questionnaire for the identified child. The questionnaire and McArthur Bates Communicative Development Inventories was then sent back to the researcher.

## Results

Of the 6 surveys that were returned, three were from parents with typically developing children and three were from parents with children that had been diagnosed with Down syndrome. Of the 3 surveys that were returned for children who were typically developing, 2 of them were within the 17-18 month range and 1 was within the 8-10 month range. Of the 3 surveys that were returned for children who had been diagnosed with Down syndrome, 2 of them were in the 8-10 month range and 1 was within the 16-18 month range. All but one of the respondents, were female.

Table 1. Age of children reported on by parents

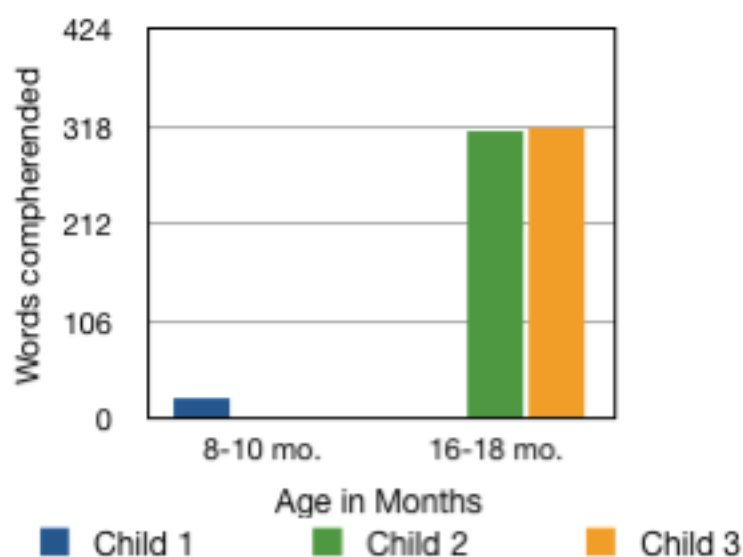
Participant #	1	2	3	4	5	6
Age	17 months	10 months	17 months	9 months	17 months	9 months
Gender	Female	Male	Female	Female	Female	Female
Development	Typical	Typical	Typical	Down Syndrome	Down Syndrome	Down Syndrome

### *Question One*

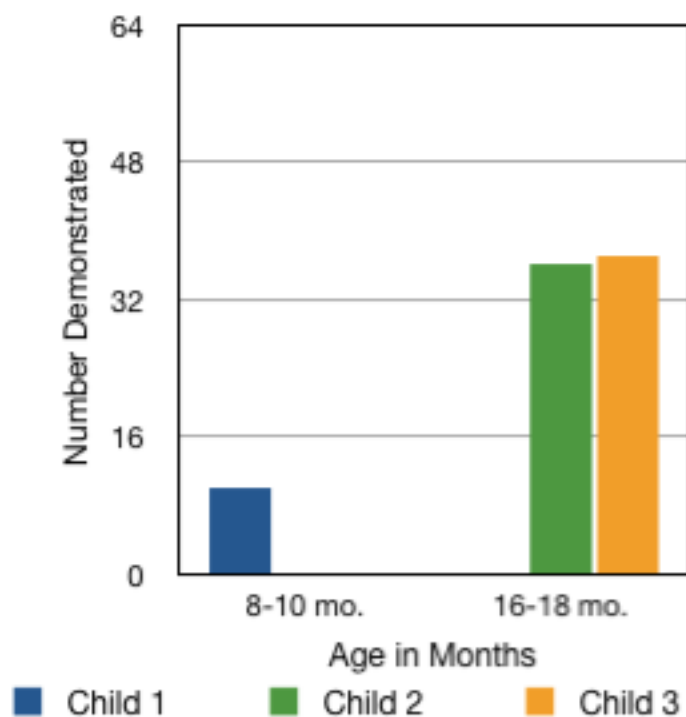
The first question of this study asked how recognition of social intention and language comprehension were related in infancy. There are 424 words on the McArthur Bates Inventories that assess the language comprehension of the infant. There are 64 items on the McArthur Bates Inventories that addressed areas of social interaction of the infant. 12 of these 64 items pertain specifically to first communicative gestures. The one survey that was collected from the 8-10 month old group of typically developing children showed that the child comprehended 22 of the 424 possible language comprehension items and either sometimes or often did 6 of the 12 first communicative

gestures. However, this data showed the child produced only 4 of the other 52 social intention items. One of the surveys from the 16-18 month old group of typically developing children showed that the child comprehended 313 of the 424 words presented on the McArthur Bates Development Inventories. This data also showed that the child often or sometimes produced 9 of the 12 first communicative gestures and 27 of the other 52 social intention items. The other survey in the 16-18 month group of typically developing children showed that the child comprehended 316 of the 424 language comprehension words. The survey also showed that the child often performed 10 of the 12 first communicative gestures and performed 27 of the other 52 social intention items. This data clearly shows that there is a definite relation between language comprehension and social intention. These two are related because as a child begins to comprehend more and more language they start to socially interact with others and produce actions that they see others doing. This data also shows that although the 10-month old only comprehended 22 of the 424 comprehension words he was producing half of the first communicative gestures. This indicates that he understood how to interact with others and communicate to get his wishes.

### Language Comprehension in Typically Developing Children



### Social Intention in Typically Developing Children

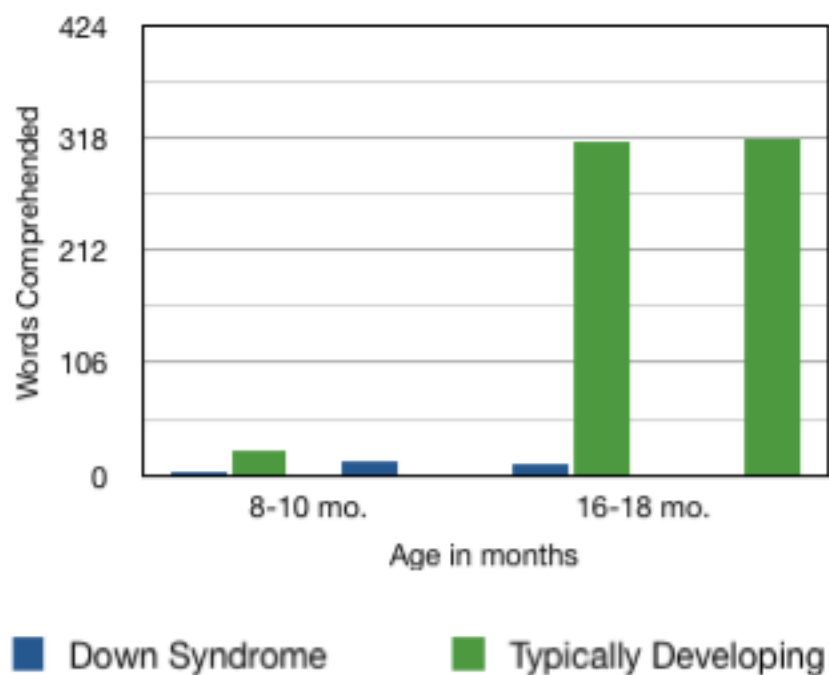


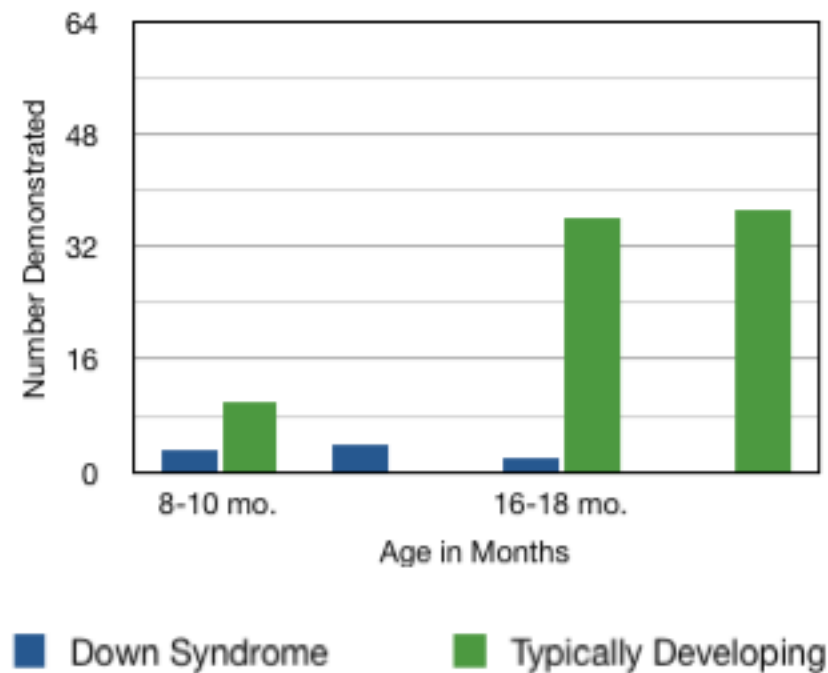
#### Question Two

The second question of the study asks if the relationship between recognition of intention and language comprehension differs for infants with Down syndrome. From one of the surveys that was collected from the 8-10 month group of children with Down syndrome only 3 of the 424 comprehension words were comprehended. The child did not exhibit any of the first communicative gestures and only demonstrated 3 of the other 52 social intention items. From the other survey that was collected from the 8-10 month group of children with Down syndrome 12 of the 424 comprehension words were comprehended. The child often or sometimes exhibited 3 of the 12 first communicative gestures and demonstrated only 1 of the other 52 social intention items. The one survey that was collected from the 16-18 month age group of children with Down syndrome showed that the child comprehended 11 of the 424 comprehension words. The child

sometimes exhibited 2 of the 12 first communicative gestures and did not demonstrate any of the other 52 social intention items. From this data there is a definite difference between language comprehension and social intention for infants with Down syndrome for both age groups. Compared with their same aged peers, the children with Down syndrome comprehended considerably fewer words and produced fewer gestures and social intentional actions. This data also shows that the comprehension of language and recognition of social intention does not increase with age like was seen with the typically developing children.

### **Difference in Language Comprehension in Typically Developing Children vs. Children with DS**



**Difference in Social Intention in Typically Developing Children vs. Children with DS****Discussion**

The purpose of this study was to investigate how children with Down syndrome develop social cognition and how it compares to typically developing children. As can be seen from the results, language comprehension and social cognitive intention is clearly related and as language comprehension increases, social intention also increases. With the typically developing children their language comprehension and social intention also increased with age. However, the results did not show this to be true for children with Down syndrome. The children with Down syndrome comprehended significantly fewer words than the typically developing children and also demonstrated fewer social intention actions. Their language comprehension and social intention did not increase with their age as seen in the typically developing children. In some cases it even decreased.



The literature on typically developing children and social cognition suggests that imitation plays a big role in social cognition, and that this is built as children see the actions of others and start to imitate them themselves (Meltzoff, 2011). There was a question on the developmental questionnaire that specifically asked if the child imitated body movements when asked to in which all of the parents of typically developing children answered yes to. There were also questions on the McArthur Bates Inventories that pertained to children imitating adult/parenting actions that were evident in the typically developing children. From the literature on children with Down syndrome and social cognition, it stated that children with Down syndrome have social cognitive difficulty with mutual gaze, pointing and requesting gestures, imitation and social referencing (Cebula et al., 2010). There were items that pertained to pointing and requesting gesture, imitation, and social referencing on the McArthur Bates Inventories and, as seen from the results, they were clearly areas of difficulty for children with Down syndrome. Also, on the question on the questionnaire about imitating body movements with asked to, all of the parents of children with Down syndrome answered no.

It was also clear from the literature that children with Down syndrome had significant language difficulties and delays (Cleland, Hardcastle, Timmins, Wishart, & Wood, 2010; Estigarribia, Martin, Klusek, & Roberts, 2009; Klein & Sobelman-Rosenthal, 2003). The results clearly showed this, especially compared to their same aged typically developing peers. The results that were obtained from the study were what was to be expected from the literature. As mentioned before, there has been limited research done on social cognition and Down syndrome with this age population, but the

research predicted the results well. It is evident from the results of this study that there is a strong connection between language and social cognitive intent. Children with Down syndrome don't develop language and social cognitive intent in progression with age like their same aged typically developing peers.

### *Limitations*

Finding parents with children diagnosed with Down syndrome in these two specific age groups was a definite limitation to this study. Although children with Down syndrome are diagnosed at a very early age, finding them is a difficult task. It was also hard to control how many surveys and inventories that I received back from each age group. It was difficult to compare the responses because of age differences. I would have liked an equal amount of responses from each age group. I also would have liked more responses in general in order to have more data.

### *Future Direction*

When collecting data on Down syndrome and social cognition, I would encourage the person to have the same amount of participants in each age group. That is something that I didn't control for and it would have been helpful in determining the results. I also think if a study like this was done in the future it would be helpful to observe infants to actually see their social interaction. This, however, would have to be done over a longer period of time.

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**Appendix A Developmental Survey**

## Demographic Information

1. How old is your child? \_\_\_\_\_
  2. Date of Birth: \_\_\_\_\_
  3. ☐ Male ☐ Female
  4. Birth status: Was your child...
    - ☐ Full Term
    - ☐ Premature—How many months? [    ]
    - ☐ Post Term—How many months? [    ]
  5. Does your child have Down syndrome? ☐ yes ☐ no
  6. Is/has your child been enrolled in a day care or infant/toddler center?
    - ☐ yes
    - ☐ no
  7. Has your child received early intervention services?
    - ☐ yes
    - ☐ no
    - a. If yes was this at ☐ home or ☐ outside facility/center
    - b. How long was your child in the early intervention program?
- 

## Social Cognition

8. Does your child make eye contact with you when you speak or talk to him/her?
  - ☐ yes
  - ☐ no
9. Does your child imitate your body movements or hand motions when you ask them to?
  - ☐ yes
  - ☐ no
10. Does your child pay more attention to you when you are talking or to a play toy that talks?
  - ☐ myself
  - ☐ toy
11. Is there any other information that you would like to give me about your child and his or her social development?